| REFERENCE: 310072 | |
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| PROJECT: 15005.1032011 | |

CONTENTS

DESCRIPTION

SUPPLEMENTAL LEGEND (GSI)

TITLE SHEET LEGEND (SOIL & ROCK)

SITE PLAN PROFILE(S) CROSS SECTION(S)

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SHEET NO.

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6-7

STATE OF NORTH CAROLINA

DEPARTMENT OF TRANSPORTATION **DIVISION OF HIGHWAYS** GEOTECHNICAL ENGINEERING UNIT

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY DURHAM

PROJECT DESCRIPTION BRIDGE NO. 72 ON SR 1637 OVER FINGER TO FALLS LAKE

STATE PROJECT REFERENCE NO. 9 310072

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (1919) 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

CENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BORCHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (IM-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOL THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS NIOCATED IN THE SUBSURFACE OR INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.

THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISTY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THE PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

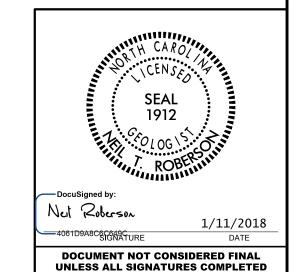
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 2. BY HAVING REQUESTED THIS INFORMATION, THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

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| | UARY 2018 |

PERSONNEL



PROJECT REFERENCE NO. SHEET NO. 2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

| COLL DECEDIDATION | CDADATION | DOCK DECEDIBITION | TERMS AND DEFINITIONS | | |
|--|--|---|---|--|--|
| SOIL DESCRIPTION SOIL IS CONSIDERED UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN | GRADATION WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE. | ROCK DESCRIPTION HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT REFUSAL IF TESTED. AN INFERRED | TERMS AND DEFINITIONS | | |
| BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO THE STANDARD PENETRATION TEST (ASSHTO T 206, ASTM DISB6), SOIL CLASSIFICATION | UNIFORMLY GRADED - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. | ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 | <u>ALLUVIUM (ALLUV.)</u> - SOILS THAT HAVE BEEN TRANSPORTED BY WATER. <u>AQUIFER</u> - A WATER BEARING FORMATION OR STRATA. | | |
| IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: | GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES OF TWO OR MORE SIZES. | BLOWS IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN | ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND. | | |
| CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE, | ANGULARITY OF GRAINS | REPRESENTED BY A ZONE OF WEATHERED ROCK. ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS: | ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVI | | |
| VERY STIFF,GRAY,SILTY CLAY,MOIST WITH INTERBEDDED FINE SAND LAYERS,HIGHLY PLASTIC,A-7-6 | THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED. | WEATHERED NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED. | A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, SUCH AS SHALE, SLATE, ETC. | | |
| | SUIL LEGEND AND AASHTU CLASSIFICATION MINERALOGICAL COMPOSITION | | ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND | | |
| GENERAL GRANULAR MATERIALS SILT-CLAY MATERIALS CLASS. (≤35% PASSING *200) (>35% PASSING *200) ORGANIC MATERIALS | MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. | CRYSTALLINE ROCK (CR) FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD STREFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE. | SURFACE. | | |
| GROUP A-1 A-3 A-2 A-4 A-5 A-6 A-7 A-1, A-2 A-4, A-5 | ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE. | UNEISS, GABBRU, SLHIST, ETC. | CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE. | | |
| CLASS. A-1-a A-1-b A-2-4 A-2-5 A-2-6 A-2-7 A-7-5 A-7-6 A-3 A-6, A-7 | COMPRESSIBILITY | NON-CHTSTALLINE SEDIMENTARY ROCK THAT WOULD YEILD SPT REFUSAL IF TESTED. | COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM | | |
| SYMBOL 000000000000000000000000000000000000 | SLIGHTLY COMPRESSIBLE LL < 31 MODERATELY COMPRESSIBLE LL = 31 - 50 | ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC. COASTAL PLAIN COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD | OF SLOPE. CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED | | |
| % PASSING SILT- | HIGHLY COMPRESSIBLE LL > 50 | SEDIMENTARY ROCK SPECIAL ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC. | BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. | | |
| *10 50 MX GRANULAR GRANULAR CLAY DEAT | PERCENTAGE OF MATERIAL | WEATHERING | DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT | | |
| *200 15 MX 25 MX 10 MX 35 MX 35 MX 35 MX 35 MX 35 MX 36 MN 36 MN 36 MN 36 MN S6 MN S6 MN | GRANULAR SILT - CLAY ORGANIC MATERIAL SOILS SOILS OTHER MATERIAL | FRESH ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING, ROCK RINGS UNDER | ROCKS OR CUTS MASSIVE ROCK. DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE | | |
| MATERIAL PASSING *40 | TRACE OF ORGANIC MATTER 2 - 3% 3 - 5% TRACE 1 - 10% LITTLE ORGANIC MATTER 3 - 5% 5 - 12% LITTLE 10 - 20% | HAMMER IF CRYSTALLINE. | HORIZONTAL. | | |
| LL 40 MX 41 MN LITTLE OR | MODERATELY ORGANIC 5 - 10% 12 - 20% SOME 20 - 35% | VERY SLIGHT ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN, (V SLI.) CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF | DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE | | |
| PI 6 MX NP 18 MX 11 MN 11 MN 18 MX 18 MX 11 MN 11 MN MODERATE DECANIC | HIGHLY ORGANIC > 10% > 20% HIGHLY 35% AND ABOVE | OF A CRYSTALLINE NATURE. | LINE OF DIP, MEASURED CLOCKWISE FROM NORTH, | | |
| UKUUP INUEX W W A AMX B MX 12 MX 16 MX NU MX AMUUN S UF SOILS | GROUND WATER | SLIGHT ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR | FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE. | | |
| USUAL TYPES STUNE HRAUS. FINE SILTY OR CLAYEY SILTY CLAYEY MATTER | ▼ WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING | CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS. | FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES. | | |
| MATERIALS SAND SAND GRAVEL AND SAND SOILS SOILS | STATIC WATER LEVEL AFTER <u>24</u> HOURS | MODERATE SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN | FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM | | |
| GEN. RATING AS SUBGRADE EXCELLENT TO GOOD FAIR TO POOR POOR UNSUITABLE | | (MOD.) GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED | PARENT MATERIAL. FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM. | | |
| PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30 | SPRING OR SEEP | WITH FRESH ROCK. | FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE | | |
| CONSISTENCY OR DENSENESS | MISCELLANEOUS SYMBOLS | MODERATELY ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL SEVERE AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH | FIELD. | | |
| COMPACTNIESS OR RANGE OF STANDARD RANGE OF UNCONFINED | [I] 05:405 | (MOD.SEV.) AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES CLUNK SOUND WHEN STRUCK. | JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED. | | |
| PRIMARY SOIL TYPE CONSISTENCY PENETRATION RESISTENCE COMPRESSIVE STRENGTH (N-VALUE) (TONS/FT ²) | ROADWAY EMBANKMENT (RE) 25/025 DIP & DIP DIRECTION WITH SOIL DESCRIPTION OF ROCK STRUCTURES | IF TESTED, WOULD YIELD SPT REFUSAL SEVERE ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED, ROCK FABRIC CLEAR AND EVIDENT BUT | LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT. | | |
| VERY LINGS (4 | - SPT | (SEV.) REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED | LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS. | | |
| GENERALLT LOOSE 4 TO 10 | SOIL STMBOL STALLATION INSTALLATION | TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF | MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS, MOTTLING IN SOILS | | |
| MATERIAL DENSE 30 TO 50 | ARTIFICIAL FILL (AF) OTHER AUGER BORING CONE PENETROMETER THAN ROADWAY EMBANKMENT AUGER BORING TEST | VERY ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE | USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE. | | |
| VERT DENSE > 2M | | SEVERE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK (V SEV.) REMAINING, SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR | PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM. | | |
| VERY SOFT < 2 < 0.25 GENERALLY SOFT 2 TO 4 0.25 TO 0.5 | - INFERRED SOIL BOUNDARY - CORE BORING SOUNDING ROD | VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. <u>IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF</u> | RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. | | |
| SILT-CLAY MEDIUM STIFF 4 TO 8 0.5 TO 1.0 | INFERRED ROCK LINE MONITORING WELL TEST BORING WITH CORE | COMPLETE ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND | ROCK QUALITY DESIGNATION (ROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF | | |
| MATERIAL STIFF 8 TO 15 1 TO 2 | A ALLUMIA COM POUNDARY A PIEZOMETER | SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE. | ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. | | |
| HARD > 30 > 4 | INSTALLATION | ROCK HARDNESS | SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT | | |
| TEXTURE OR GRAIN SIZE | RECOMMENDATION SYMBOLS | VERY HARD CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES | ROCK. | | |
| U.S. STD. SIEVE SIZE 4 10 40 60 200 270 OPENING (MM) 4.76 2.00 0.42 0.25 0.075 0.053 | UNCLASSIFIED EXCAVATION - UNDERCUT UNDERCUT UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE | SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK. | SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO | | |
| COARSE FINE | SHALLOW SHOLLOW UNCLASSIFIED EXCAVATION - USED IN THE TOP 3 FEET OF | HARD CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN. | THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS. | | |
| BOULDER COBBLE GRAVEL SAND SAND SILT CLAY | UNDERCOT LEED HOUSE DEGRADABLE ROCK | MODERATELY CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE | SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT | | |
| (LSE, SU.) (F SU.) | ABBREVIATIONS ABOUTED REFUEL MEDIUM NOT WANT CHEED TEST | HARD EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK, HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS. | OR SLIP PLANE. | | |
| GRAIN MM 305 75 2.0 0.25 0.05 0.005 SIZE IN 12 3 | AR - AUGER REFUSAL MED MEDIUM VST - VANE SHEAR TEST BT - BORING TERMINATED MICA MICACEOUS WEA WEATHERED | MEDIUM CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. | STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL | | |
| SOIL MOISTURE - CORRELATION OF TERMS | CL CLAY MOD MODERATELY 7 - UNIT WEIGHT | HARD CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE | WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER, SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. | | |
| COLL MOISTINE COLE FIELD MOISTINE | CPT - CONE PENETRATION TEST NP - NON PLASTIC 7d- DRY UNIT WEIGHT CSE COARSE ORG ORGANIC | POINT OF A GEOLOGIST'S PICK. SOFT CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK, CAN BE EXCAVATED IN FRAGMENTS | STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY | | |
| (ATTERBERG LIMITS) DESCRIPTION GUIDE FOR FIELD MOISTURE DESCRIPTION | DMT - DILATOMETER TEST PMT - PRESSUREMETER TEST SAMPLE ABBREVIATIONS DPT - DYNAMIC PENETRATION TEST SAP SAPROLITIC S - BULK | FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN | TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE. | | |
| - SATURATED - USUALLY LIQUID; VERY WET, USUALLY | e - VOID RATIO SD SAND, SANDY SS - SPLIT SPOON | PIECES CAN BE BROKEN BY FINGER PRESSURE. VERY CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH | STRATA ROCK QUALITY DESIGNATION (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY | | |
| (SAT.) FROM BELOW THE GROUND WATER TABLE | F - FINE SL SILT, SILTY ST - SHELBY TUBE FOSS FOSSILIFEROUS SLI SLIGHTLY RS - ROCK | SOFT OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY | THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE. | | |
| PLASTIC SEMICOLID. PEOLIDES DRYING TO | FRAC FRACTURED, FRACTURES TCR - TRICONE REFUSAL RT - RECOMPACTED TRIAXIAL | FINGERNAIL. | TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER. | | |
| ATTAIN OPTIMUM MOISTURE | FRAGS FRAGMENTS | FRACTURE SPACING BEDDING | BENCH MARK: N/A | | |
| | EQUIPMENT USED ON SUBJECT PROJECT | TERM SPACING TERM THICKNESS VERY WIDE MORE THAN 10 FEET VERY THICKLY BEDDED 4 FEET | FLEVATION: N/A FEET | | |
| OM OPTIMUM MOISTURE - MOIST - (M) SOLID; AT OR NEAR OPTIMUM MOISTURE | DRILL UNITS: ADVANCING TOOLS: HAMMER TYPE: | WIDE 3 TO 10 FEET THICKLY BEDDED 1.5 - 4 FEET MODERATELY CLOSE 1 TO 3 FEET THINLY BEDDED 0.16 - 1.5 FEET | ELEVATION: N/A FEET | | |
| SL _ SHRINKAGE LIMIT | CME-45C CLAY BITS X AUTOMATIC MANUAL | CLOSE 0.16 TO 1 FOOT VERY THINLY BEDDED 0.03 - 0.16 FEET | NOTES: | | |
| - DRY - (D) REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE | 6' CONTINUOUS ELIGHT AUGER | VERY CLOSE LESS THAN 0.16 FEET THICKLY LAMINATED 0.008 - 0.03 FEET THINLY LAMINATED < 0.008 FEET | EXISTING GROUND ELEVATIONS TAKEN FROM redwood_20171024.TIN FILE DATED 10/24/2017 AND .GPK FILE DATED 09/19/2017 | | |
| PLASTICITY | X CME-55 CORE SIZE: -H | INDURATION | | | |
| | | FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC. | BOREHOLE ELEVATIONS TAKEN FROM 32P072_Is_tin.tin FILE DATED 04/20/2017 | | |
| PLASTICITY INDEX (PI) DRY STRENGTH NON PLASTIC 0-5 VERY LOW | TUNGCARBIDE INSERTS | FRIABLE RUBBING WITH FINGER FREES NUMEROUS GRAINS; | EXISTING WATER ELEVATION TAKEN FROM BRIDGE SURVEY AND HYDRAULIC DESIGN REPORT DATED 12/04/2017 | | |
| SLIGHTLY PLASTIC 6-15 SLIGHT MODERATELY PLASTIC 16-25 MEDIUM | VANE SHEAR TEST CASING WY ADVANCER HAND TOOLS: | GENTLE BLUW BY HAMMER DISINTEGRATES SAMPLE. | AND HYDRAULIC DESIGN REPORT DATED 12/04/2017 | | |
| HIGHLY PLASTIC 16-25 MEDIUM HIGHLY PLASTIC 26 OR MORE HIGH | POST HOLE DIGGER | MODERATELY INDURATED GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER. | | | |
| COLOR | TOUGHT TOUGHT | CRAINS ARE DISCISSED TO SERAPATE WITH STEEL PROPE. | | | |
| DESCRIPTIONS MAY THE UPE COLOR OR COLOR SAMETHATIONS (TAN DESCRIPTIONS ASSESSMENT) | | INDURATED OFFICULT TO BREAK WITH HAMMER. | | | |
| DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE. | CORE BIT VANE SHEAR TEST | SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; | | | |
| | <u> </u> | SAMPLE BREAKS ACROSS GRAINS. | DATE: 8-15-14 | | |

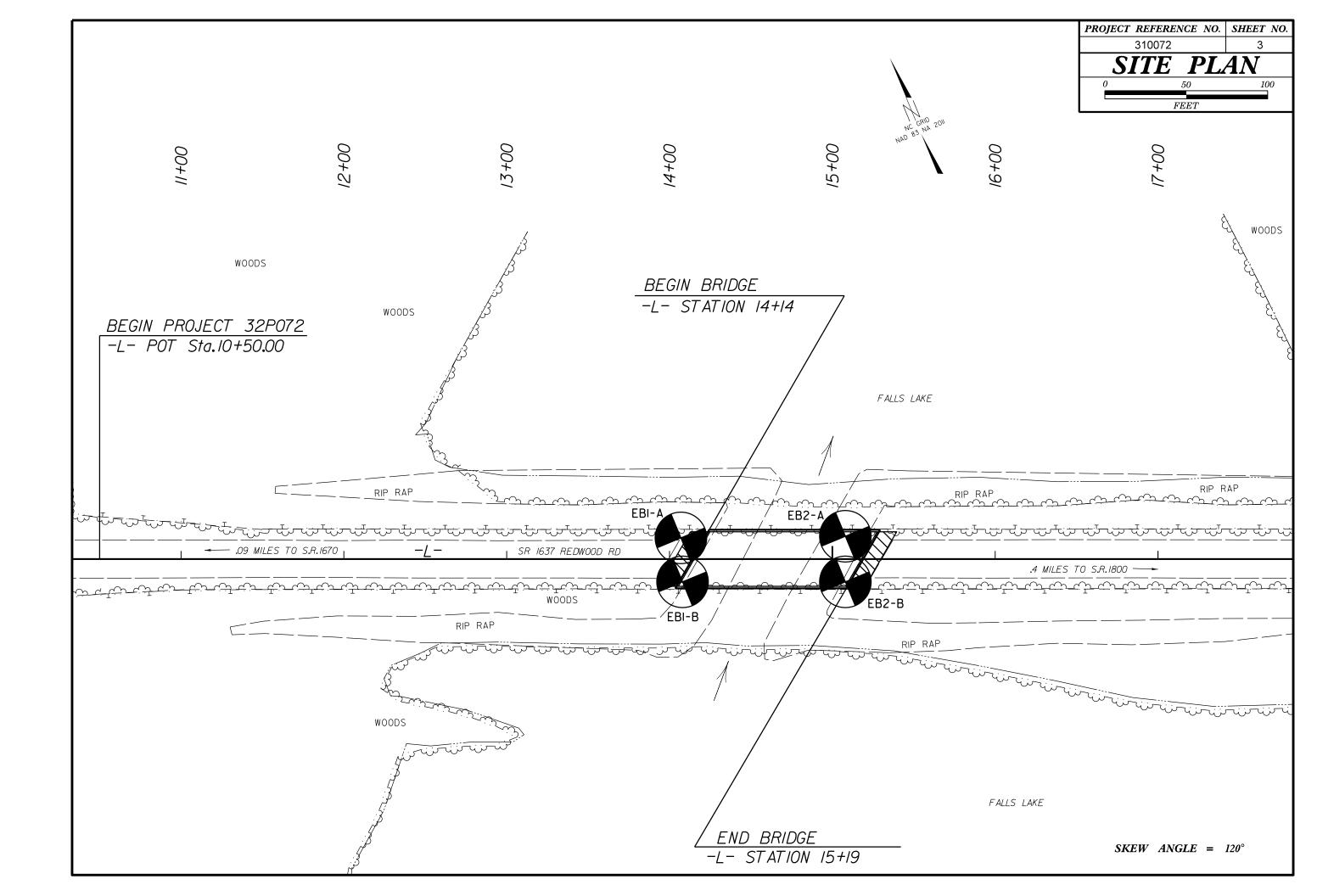
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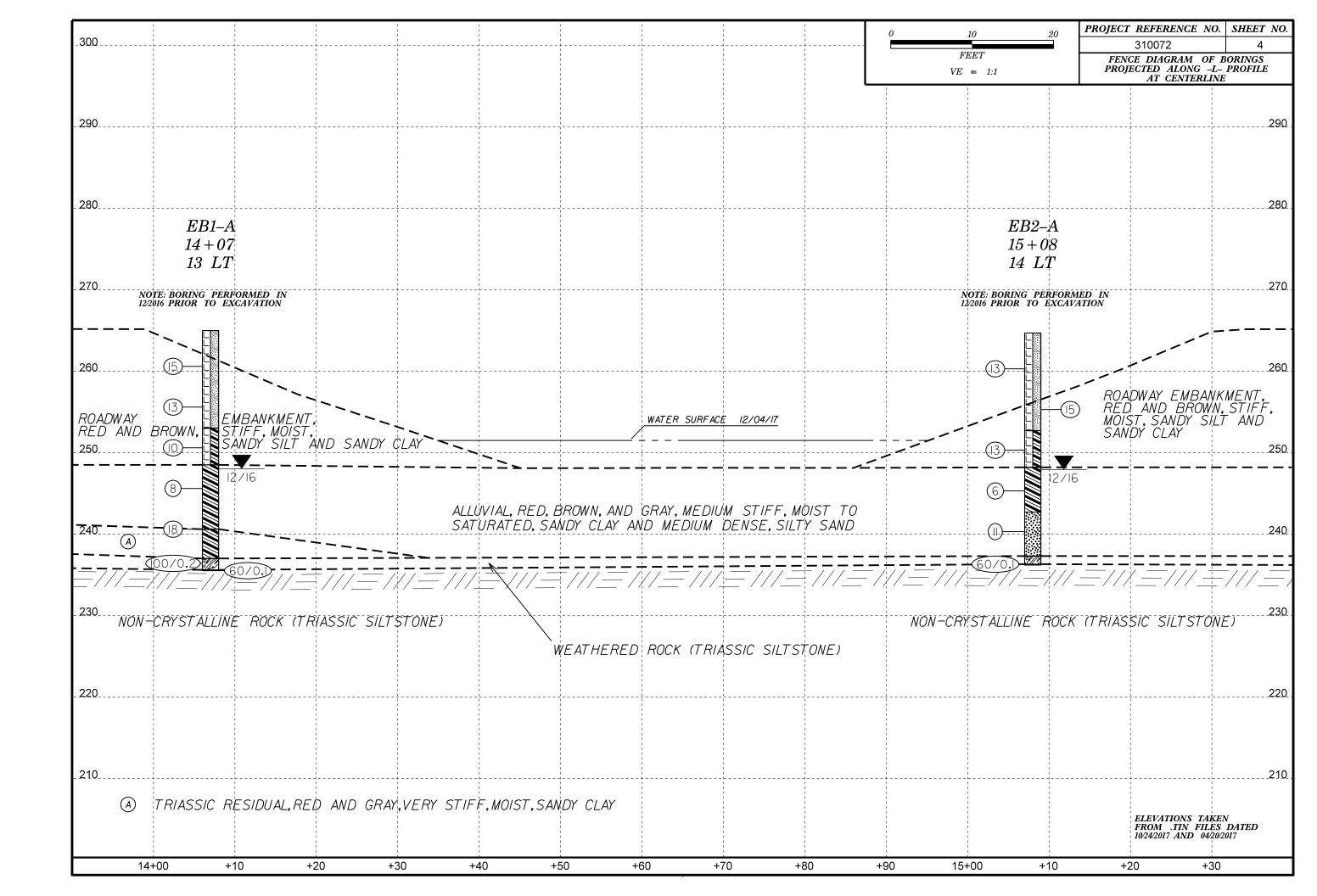
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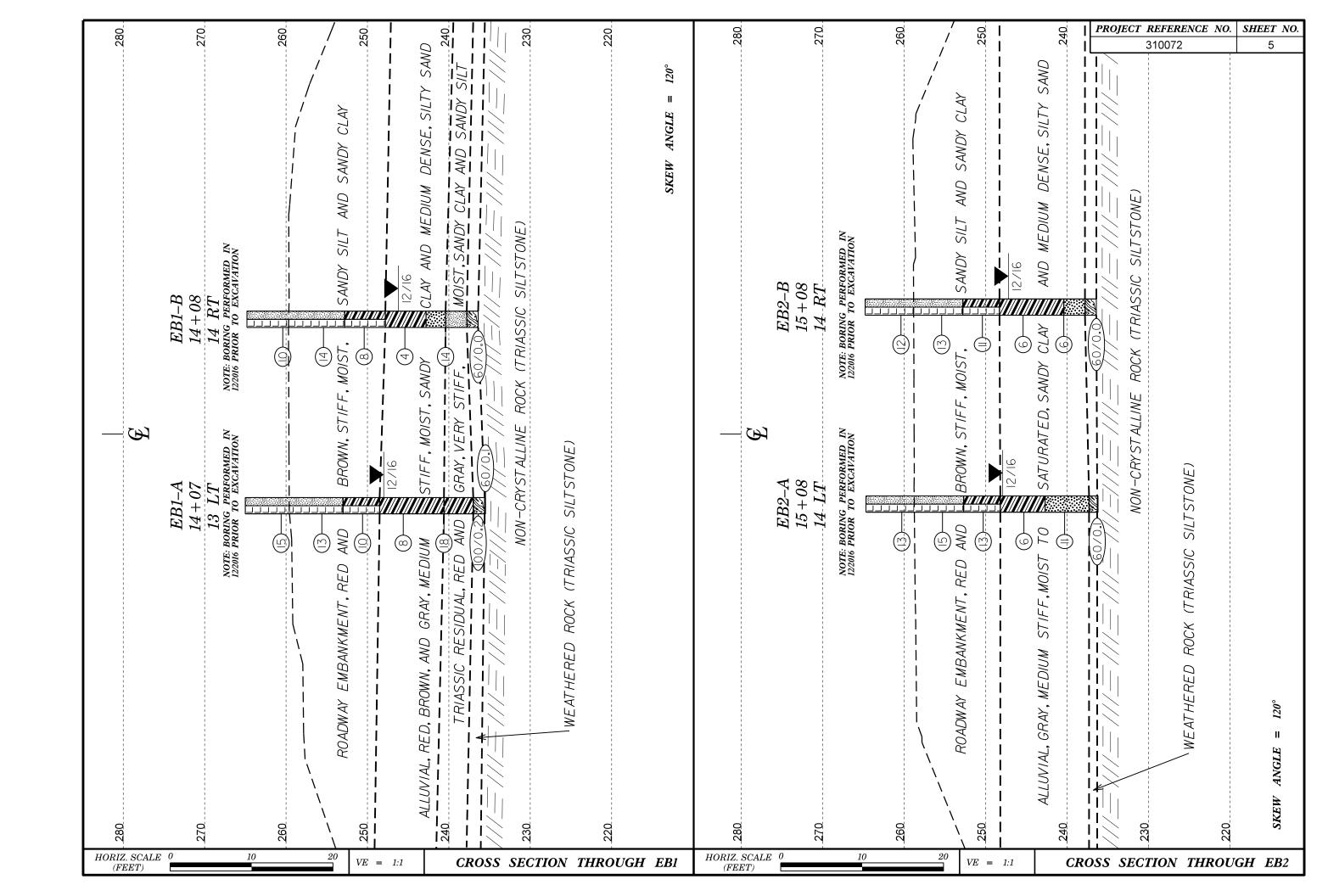
SUBSURFACE INVESTIGATION

SUPPLEMENTAL LEGEND, GEOLOGICAL STRENGTH INDEX (GSI) TABLES

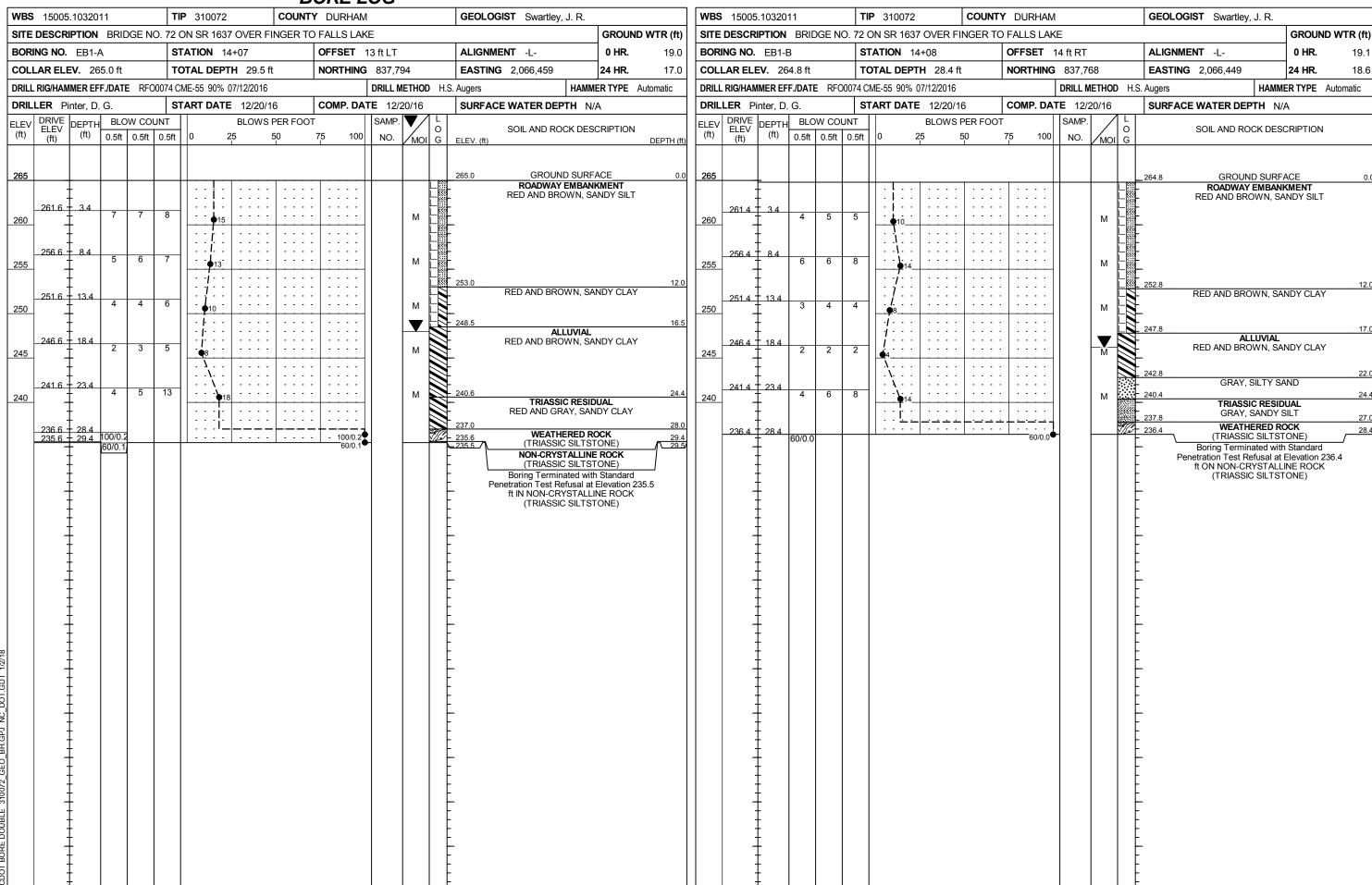
| AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Join | nted Ro | ock Mass (Marinos and Hoek, 2 | 2000) | | | AASHTO LRFD Figure 10.4.6.4-2 — Determination of GSI for Tectonically Def | ormed Hetero | geneous Rock | Masses (Marı | nos and Hoek, | , 2000) |
|--|--------------------|---|--|---|---|---|---|---|---|---|--|
| GEOLOGICAL STRENGTH INDEX (GSI) FOR JOINTED ROCKS (Hoek and Marinos, 2000) | | aces ned | | м Ф О | | GSI FOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos.P and Hoek E., 2000) | | | | | |
| From the lithology, structure and surface conditions of the discontinuities, estimate the average value of GSI. Do not try to be too precise. Quoting a range from 33 to 37 is more realistic than stating that GSI = 35. Note that the table does not apply to structurally controlled failures. Where weak planar structural planes are present in an unfavorable orientation with respect to the excavation face, these will dominate the rock mass behaviour. The shear strength of surfaces in rocks that are prone to deterioration as a result of changes in moisture content will be reduced if water is present. When working with rocks in the fair to very poor categories, a shift to the right may be made for wet conditions. Water pressure is dealt with by effective stress analysis. | SURFACE CONDITIONS | VERY G00D Very rough, fresh unweathered surf G00D Rough, slightly weathered, iron stai | FAIR Smooth, moderately weathered and altered surfaces | POOR Slickensided, highly weathered surfawith compact coatings or fillings or angular fragments VERY POOR Slickensided, highly weathered surfa | | From a description of the lithology, structure and surface conditions (particularly of the bedding planes), choose a box in the chart. Locate the position in the box that corresponds to the condition of the discontinuities and estimate the average value of GSI from the contours. Do not attempt to be too precise. Quoting a range from 33 to 37 is more realistic than giving GSI = 35. Note that the Hoek-Brown criterion does not apply to structurally controlled failures. Where unfavourably oriented continuous weak planar discontinuities are present, these will dominate the behaviour of the rock mass. The strength of some rock masses is reduced by the presence of groundwater and this can be allowed for by a slight shift to the right in the columns for fair, poor and very poor conditions. Water pressure does not change the value of GSI and it is dealt with by using effective stress analysis. | VERY GOOD - Very Rough, fresh unweathered surfaces | G00D - Rough, slightly weathered surfaces | FAIR - Smooth, moderately weathered and altered surfaces | POOR - Very smooth, occasionally slickensided surfaces with compact coatings or fillings with angular fragments | VERY POOR - Very smooth, slicken- sided or highly weathered surfaces with soft clay coatings or fillings |
| STRUCTURE | | DECREASING SU | JRFACE QU | ALITY - | | COMPOSITION AND STRUCTURE | | | | | |
| INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities BLOCKY - well interlocked un- | PIECES | 90 | | N/A N/A | A | A. Thick bedded, very blocky sandstone The effect of pelitic coatings on the bedding planes is minimized by the confinement of the rock mass. In shallow tunnels or slopes these bedding planes may cause structurally controlled instability. | 70 60 | A | | | |
| disturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets | OF ROCK | 70 60 | | | | 8. Sand- stone with stone and siltstone with sand- siltstone with sand- with sand- | | 50 B | c / [|) E | |
| VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets | OCKING | 5 | | | | layers of siltstone state with sandstone layers | | 40 | | | |
| BLOCKY/DISTURBED/SEAMY - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity | ASING INTERL | | 40 | 30 | | C.D.E. and G - may be more or less folded than illustrated but this does not change the strength. Tectonic deformation, faulting and loss of continuity moves these categories to F and H. | | | 30 | F 20 | |
| DISINTEGRATED - poorly inter- locked, heavily broken rock mass with mixture of angular and rounded rock pieces | - DECRE | | | 20 | | G. Undisturbed silty or clayey shale with or without a few very thin sandstone layers H. Tectonically deformed silty or clayey shale forming a chaotic structure with pockets of clay. Thin layers of sandstone are transformed | | | \$ | | 10 |
| LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes | ♡ | N/A N/A | | 10 | | Into small rock pieces. → Means deformation after tectonic disturbance | | | | | |







GEOTECHNICAL BORING REPORT BORE LOG



GEOTECHNICAL BORING REPORT BORE LOG

| | | RE LOG | | | | | | | | |
|---|-----------------------------------|---|--|--|--|-------------------------|------------------------------------|---------------------------|--|---|
| WBS 15005.1032011 | TIP 310072 COUNTY DU | <u> </u> | OGIST Swartley, J. R. | | WBS 15005.103 | | | TY DURHAM | GEOLOGIST Swartley, J. R. | |
| SITE DESCRIPTION BRIDGE NO | 72 ON SR 1637 OVER FINGER TO FALI | LS LAKE | | GROUND WTR (ft) | SITE DESCRIPTION | N BRIDGE N | O. 72 ON SR 1637 OVER FINGER | TO FALLS LAKE | | GROUND WTR (ft) |
| BORING NO. EB2-A | STATION 15+08 OFF | SET 14 ft LT ALIGI | IMENT -L- | 0 HR. 19.2 | BORING NO. EB | 2-B | STATION 15+08 | OFFSET 14 ft RT | ALIGNMENT -L- | 0 HR. 18.7 |
| COLLAR ELEV. 264.7 ft | TOTAL DEPTH 28.5 ft NOR | RTHING 837,756 EAST | NG 2,066,553 | 24 HR. 16.8 | COLLAR ELEV. | 264.8 ft | TOTAL DEPTH 28.4 ft | NORTHING 837,730 | EASTING 2,066,542 | 24 HR. 17.6 |
| DRILL RIG/HAMMER EFF./DATE RF00 | 074 CME-55 90% 07/12/2016 | DRILL METHOD H.S. Augers | HAMN | MER TYPE Automatic | DRILL RIG/HAMMER | EFF./DATE RFC | 00074 CME-55 90% 07/12/2016 | DRILL METHOD | H.S. Augers HAM | MER TYPE Automatic |
| DRILLER Pinter, D. G. | <u> </u> | MP. DATE 12/20/16 SURF | ACE WATER DEPTH N | /A | DRILLER Pinter, | | START DATE 12/20/16 | COMP. DATE 12/20/16 | SURFACE WATER DEPTH | √A |
| ELEV (ft) DRIVE ELEV (ft) DEPTH BLOW COUNT (ft) 0.5ft 0.5ft (| | 100 NO. MOI G ELEV. (fi | | DEPTH (ft) | ELEV CHI DENCE CHI | D 0.5ft 0.5ft | UNT BLOWS PER FOO 0.5ft 0 25 50 | OT SAMP. 75 100 NO. MOI | SOIL AND ROCK DE | |
| 261.3 3.4 8 6 261.3 3.4 8 6 256.3 8.4 6 6 255.3 13.4 3 6 250 251.3 13.4 3 6 246.3 18.4 2 3 | 7 | M 252.7 M 248.2 M 248.2 M 248.2 M 248.2 | GROUND SURI ROADWAY EMBAN RED AND BROWN, SI ALLUVIAL GRAY, SANDY GRAY, SILTY SI WEATHERED FOR (TRIASSIC SILTS NON-CRYSTALLIN (TRIASSIC SILTS Boring Terminated with Penetration Test Refusal aft IIN NON-CRYSTALL (TRIASSIC SILTS) | ANDY SILT 12.0 ANDY CLAY 16.5 CLAY 22.0 SAND ROCK 28.4 TONE) E ROCK 70NE) th Standard the Elevation 236.2 JINE ROCK 236.2 | 265 | 4 4 7 6 4 5 4 3 2 4 3 2 | 8 | M M M M W W W W W | Z64.8 GROUND SUR ROADWAY EMBA RED AND BROWN, S Z52.8 RED AND BROWN, S ALLUVIAL GRAY, SANDY Z37.8 WEATHERED (TRIASSIC SILT: Boring Terminated w Penetration Test Refusal a fit ON NON-CRYSTAL (TRIASSIC SILT: (TRIASSIC SILT: | 12.0 ANDY CLAY 16.5 CLAY 24.4 SAND 27.0 ROCK 28.4 STONE) th Standard at Elevation 236.4 LINE ROCK |
| ACDOT BORE E | | | | | | | | | - - - - | |

SITE PHOTOGRAPH

Bridge No. 72 on –L– (SR 1637) over Finger to Falls Lake



Looking West towards End Bent 1